

Vicki Jo Sandstead

## History's Big Lessons

**T**wenty years ago, in his popular series *Cosmos*, Carl Sagan mused that it is only in the last 400 years that we have come to understand the forces of and our place in the universe. We are even newer to understanding our planet and the energy that shapes it. We do know that violent catastrophic activities have sculpted Earth, changing its history and that of civilization since the beginning of time. This article will explore geological events—those associated with Earth's crust that may have influenced the course of civilization.

To picture Earth's crust, imagine the seams of a baseball. A dominant seam circles the Pacific Ocean and is the source of American and Japanese tectonic plate collisions that cause earthquakes. This "Ring of Fire" also contains three-quarters of the Earth's volcanoes. Every year, the energy released by Earth's crust in earthquakes and volcanoes is equal to 100,000 nuclear bombs.

Another seam, very similar to California's San Andreas Fault, extends from eastern Turkey to Greece and is known as the Anatolian Fault. Like its American counterpart, it is a network of smaller fault segments that divide two tectonic plates—Eurasia and Anatolia. Nearby, the Arabian plate, moving north slightly faster than its neighbor the African plate, has crafted the Caucasus Mountains. The African plate has been shrinking the Mediterranean basin at the heart of what we call the cradle of Western civilization. Remnants of ancient sea floors remain; however, most rock was pressed down toward Earth's mantle, melting and producing magma that resurfaces through cracks forming volcanoes like Mount Ararat in Turkey. Also in Turkey, the earliest known artistic depiction of a volcano, dating about 6200 BC, is found in the stone-age site Catal Huyuk.

According to Columbia University geophysicists Bill Ryan and Walter Pitman,<sup>1</sup> the Anatolian fault may have triggered the first catastrophic event for which written records survive—an enormous flood that turned a freshwater lake into the Black Sea about 7,600 years ago. Riverbanks and freshwater sources have always attracted farmers and settlements to them. The lake was much lower and smaller at the end of the Ice Age. As glaciers melted, rising seas carved today's Bosphorus from the Sea of Marmara into the Black Sea basin. Calculations indicate that the level of the lake would have risen half a foot per day. Villages would have disappeared under water in a couple of weeks. Escaping would have required inhabitants to travel between a half and one mile per day. A beach has been discovered below 550 feet of water near the Black Sea's south shore. Was this the sequence of events in the Old Testament narrative of Noah? I suspect that early agrarian culture was no less devastated than the Midwestern U.S.A. farmer was in the "great flood of 1993."

History has many lessons for today. On August 17, 1999,<sup>2</sup> a vast section of the Golcuk, Turkey, waterfront sank 50 feet into the sea. The lower floors of two seven-story buildings plunged into the gulf of Marmara, killing 50 men gambling in a ground-floor cafe. Official earthquake deaths were over 17,000. Some 85,000 buildings were destroyed and 40,000 families left homeless. In the past 2,000 years, almost 600 earthquakes have been documented. There have been 40 earthquakes of 7+ magnitude since the first century AD. There have been 13 major earthquakes

*Midwest flooded farm, 1993.*

*Photo courtesy FEMA.*



in Turkey since 1939. Two of these, which destroyed much of Istanbul in 1509 and again in 1766, are part of a 250-year rupture cycle—the math on that adds up to the next one occurring around 2016.

Concurrent with Turkey's coasts dropping into the sea, the land in Greece is rising. Along the Gulf of Corinth one can see quarried rocks that were originally laid underwater to build a harbor around 500 BC. However, modern day Athenians were surprised when on September 7, 1999, there was a 5.9 magnitude earthquake that lasted a mere 15 seconds, killing 143 people and leaving more than 50,000 homeless.

The earliest advanced civilization of Europe, the Bronze Age Minoans were farmers and seafaring merchants who traded in the Mediterranean. They flourished and declined in the space of a few hundred years. Their sophistication included architecture with light and airshafts and bathrooms with water supply. Around 1500 BC, a great earthquake destroyed the center of their agricultural economy on Crete. After they rebuilt, another major quake occurred. Knossos survived in the 14th and 13th centuries under Mycenaean domination. When a major earthquake in 1250 BC demolished the city of Mycenaea, they rebuilt; but 50 years later another earthquake leveled the area. By the 12th century BC, both cultures were wiped out and history entered the Greek Dark Age.

A recent U.S. Geological Survey (USGS) study says the odds are 7 in 10 that an earthquake of at least 6.7 magnitude will strike the San Francisco area before 2030. In 1989, the Loma Prieta epicenter, 60 miles south of San Francisco, resulted in 68 deaths and seven billion dollars in property damage. The largest quake to hit the continental U.S. since 1906, Loma Prieta was the first before a prime-time TV audience watching the third game of the World Series between the Oakland Athletics and the San Francisco Giants. Geologic technology that measures movement and assesses faults indicates the Loma Prieta earthquake did little to relieve seismic pressure building since 1906.

The research of volcanologist Haraldur Sigurdsson<sup>3</sup> penetrates the effects of geophysical events on ancient cultures and provides us new understanding. Working with archeologists, Professor Sigurdsson has reshaped our views of the effects of disasters on ancient civilization by calibrating melted glass, carbonized vegetables,

cooked people, blown-down walls, and dislodged and collapsed roofs. For the same Minoan culture that suffered earthquakes, a gigantic eruption of the volcano Santorini on Thera, 70 miles away, brought culture nearly to an end around 1650 BC. The amount of magma from this explosion is estimated at 84 million tons. One of the largest eruptions in the last 10,000 years, three times as much ash spewed out as previously believed, enough to cover the state of Ohio under a layer more than 10 feet deep. This magnitude of ash would destroy crops and the grasses that fed livestock and totally wipe out any agrarian economy. Some scholars propose this is the biblical plague of Exodus when “there was a thick darkness in all the land of Egypt for three days.”<sup>4</sup>

In Europe, Naples is the center of the most active geologic zone. An earthquake in February of AD 62 was centered near Pompeii, a city of 20,000. Buildings collapsed in nearby Naples. Historians believed for a long time that in AD 79 falling ash from a volcanic eruption of Vesuvius buried Pompeii, and that the more prosperous Herculaneum, home to 4,500 people, was inundated in slower massive mudflows that allowed residents to escape.

Professor Sigurdsson scrutinizes 2,000-year-old archeological evidence from this prime real estate to provide a different chilling story. The terminal velocity of falling fist-sized rocks was 112 miles per hour. The rate of raining rocks was 84 per minute per square yard. The density of dead in a beachfront shelter was three per square meter. Vesuvius' output at the eruption's height was 165,000 tons of debris per second. Sigurdsson also uses the eruption's most insightful witness, the 17-year-old Pliny the Younger, whose letters are the oldest surviving historical observation of volcanic eruption. His uncle, Pliny the Elder, commander of the Roman Fleet at Misenum and the most important reporter of Roman science from that era, died at Stabiae during this eruption of Vesuvius.

In the last 10,000 years, the Naples area has experienced 100 explosive events. Around 570 BC, the Roman poet Virgil describes Etna in his poem the *Aeneid*, which certainly influenced the later writing of Dante and Saint Augustine about the underworld. In *Metamorphoses*, Ovid compares the volcano Etna to a living beast that breathes out flames and describes how the beast's orifices change as he moves. Vesuvius has erupted over 50 times since AD 79.<sup>5</sup> In 1631, mud and

lava flows killed 3,500 people. Its most recent eruption was in 1944. Today, Vesuvius' prime slopes are again crowded with nearly a million people living in the evacuation zone. Modern man may no longer attribute catastrophes to hell, beasts, or angry gods, but he persists in building in harm's way!

While much of recorded eyewitness history in other parts of the world describes disasters, in the Americas geological records are relied upon. One of our most popular national parks, Crater Lake, is now a dead volcano, but the area around it is active, smoking and fuming and under watch. When Mt. St. Helens exploded in 1980, a layer of ash blanketed Spokane, 250 miles away. This is estimated at only 1/40 the ash produced by Santorini in 1650 BC. The eruption that created Crater Lake in 4600 BC was more comparable to Santorini than to Mt. St. Helens! A similar event is within the realm of possibility today.

Many of our spectacular national parks were born of catastrophic disasters.<sup>6</sup> In Alaska, the 1912 eruption in Katmai National Park<sup>7</sup> formed the Valley of Ten Thousand Smokes.<sup>8</sup> More than seven cubic miles of ash covered 46,000 square miles in 60 hours. Robert Griggs wrote about it in *National Geographic* in 1917.

The magnitude of the eruption can perhaps be best realized if one could imagine a similar outburst centered in New York City. All of Greater New York would be buried under from 10 to 15 feet of ash; Philadelphia would be covered by a foot of gray ash and would be in total darkness for 60 hours; Washington and Buffalo would receive a quarter of an inch of ash, with a shorter period of darkness. The sound of the explosion would be heard in Atlanta and St. Louis, and the fumes noticed as far away as Denver, San Antonio, and Jamaica.

Formed about 2,300 years ago, New Mexico's Capulin Volcano is one of the youngest features in the Raton-Clayton volcanic field. Hawaii Volcanoes<sup>9</sup> National Park has very active volcanoes. Hawaiian culture has many fascinating nature-myths that reflect their constant exposure to volcanoes. Mount Kilauea has been continuously erupting since 1823.<sup>10</sup> In 1996, the volcano destroyed 181 homes and a National Park Service visitor center. Yellowstone National Park, a "hot spot" like Hawaii, has had three very large eruptions in the last two million years.

It is remarkable that many national parks illustrate the effects of violent events, yet we do

not believe in the inevitability of geophysical occurrences enough to mandate thorough catastrophic disaster planning and preparation! Planning and preparation are essential, predicated on the knowledge that disasters do happen, that they will happen. To listen and not heed, to read and not respond is foolhardy. Planning and preparedness are essential for life and property. They are also proper stewardship for the natural and historic resources under our protection.

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### Notes

- <sup>1</sup> William Ryan and Walter Pitman, *Noah's Flood*, Simon & Schuster, New York, New York, 1998.
- <sup>2</sup> This was one of the five deadliest earthquakes of the 20th century. In 1976, the 7.8 magnitude Tangshan earthquake in China killed around 240,000 people. The September 1923 earthquake in Japan claimed 140,000 lives. The deadliest recorded occurred in 1556 in China, and took the lives of nearly one million people.
- <sup>3</sup> Haraldur Sigurdsson, *Melting the Earth*, Oxford University Press, New York, New York, 1999; *Encyclopedia of Volcanoes*, Academic Press, San Diego, CA, 1999.
- <sup>4</sup> J.G. Bennett, "Geophysics and Human History: New Light on Plato's Atlantis and the Exodus," *Systematics* 1:127-56.
- <sup>5</sup> Robert Decker and Barbara Decker, *Volcanoes*, 3rd edition.
- <sup>6</sup> A few others are:  
Arizona—Sunset Crater Volcano National Monument and Chiricahua National Monument  
California—Devils Postpile National Monument, Lava Beds National Monument, Pinnacles National Monument, Lassen Peak National Park last erupted from 1914 to 1917  
Idaho—Craters of the Moon National Monument and Washington-Mount Rainier National Park
- <sup>7</sup> Although most volcanoes in the Valley of Smokes are now dead, Mount Trident, a new vent on the west flank of Katmai, became active in 1949, and has exploded several times, most recently in 1974.
- <sup>8</sup> As the Pacific plate moves over the top of this hot spot over tens of millions of years, each volcanic island was created as hot plumes of magma rose from within the earth's mantle and broke through the earth's crust.
- <sup>9</sup> Probably the most studied volcano in the world, it has written records dating back to 1823, which make it an ideal test site for a new system to predict eruptions using a network of receivers hooked into the satellite GPS.

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